

conditions of the equipment in furnace such as the whole burden 3, chute 2 and stock-rod etc., so as to create advantageous conditions for image processing for burden. The visual signal of video camera 19 and the signal of temperature measurement 20 is extracted from sealed cup 18 of connecting line, sent to guards' room through special cable, connected to video recorder 23, monitor 24, digital thermometer 25, to ensure the operators to be able to see and record the working conditions of the equipment in furnace such as burden 3 and chute 2 etc., and to know the working status through the temperature of video camera 19. Meanwhile the visual signal can be inserted to computer 26 for image processing. The quantitative data for distribution of gas flow and temperature distribution can be displayed at color monitor 27 in the forms of super twisted nematic color graph, numerical graph, and curve graph, for use in guiding the operation of blast furnace.

The inventor makes industrial experiment at several blast furnaces in accordance with the above-mentioned implementation patterns. The practice proves that for the plug-in furnace & kiln -oriented video camera and the image processing system of the invention, in addition to be able to obtain the above-mentioned beneficial effects, they have the following advantages: the video camera of the invention can be continuously used for long term, and they can be serviced under the conditions without stopping production.

Although the above-mentioned embodiment takes the blast furnace of iron-making as example, however what the technicians of the field can easily understand is the plug-in furnace & kiln-oriented video camera and image processing system are not only suitable for blast furnaces, but also suitable for various vertical furnaces and the other industrial furnaces & kilns.

### Claims

1. A plug-in furnace & kiln-oriented video camera, comprising a body of video camera, a video recorder (23) and a digital thermometer (25); the body of video camera comprising a video camera (19), a pick-up gun (16), a pipe-typed cooler (9), a sealing device (15), a sight hole (21), a blow-down ring (22), and a temperature measurement element (20);

wherein the video camera (19) is installed at the front end of pick-up gun (16), inserted into the furnace through the pipe-typed cooler (9) installed at the flange short pipe (4) of furnace shell;

the temperature measurement element is located near the top of video camera (19) in pick-up (16); a ring gap of blow-down video camera (19) is formed between blow-down ring (22) and video camera (19);

a double sealing structure of valve (13) and sealing sheath (15) is used;

video camera (19) uses lens of wide angle, with angle of view at 90~120°;

a double gas protection for blow-down wind through ring gap via inner wind from sight hole (21) and outside blow-down from sight hole (21) is employed;

video recorder (23), monitor (24) and digital thermometer (25) are placed outside furnace shell, connected respectively through cable line to video camera (19) and temperature measurement element (20).

2. The plug-in furnace & kiln-oriented video camera as claimed in claim 1, wherein the said industrial furnace & kiln is blast furnace of iron – smelting (1); the said video camera (19) is micro video camera;

the said pipe-typed cooler (9) has a diameter ranging up to 60~200 mm and a length ranging up to 200~3000mm;

the said sight hole (21) has an aperture up to  $\Phi 3 \sim \Phi 15$ mm;

the width of the gap of the said blow-down gap (28) is 0.2~3.0mm.

3. The plug-in furnace & kiln-oriented video camera as claimed in claim 2, wherein the said micro video camera uses the CCD with wide range of light sensing.

4. An image processing system, comprising the following devices:

A body of video camera, using the body of video camera mentioned in claim 2 and claim 3 of the invention, it receives the infrared light emitted from furnace charge and it is transformed into the infrared image of the burden and the adjacent equipment in the furnace, when the furnace operates without visible light;

A computer, making image process for the image, and getting the quantitative data of gas distribution and temperature distribution of the burden; and

A color monitor, in accordance with the relative relation between the strength of infrared light and the temperature of the measured object, to transform the gray values of various points in the image into temperature value, and to be displayed the distribution status of temperature or gas for the burden in the forms of STN color diagram, numerical diagram and curve diagram.